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SWIMMING PERFORMANCE OF HEAD STARTED KEMP'S RIDLEY SEA TURTLES

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Kemp's ridley hatchlings are reared in captivity (head started) at the National Marine Fisheries Service Southeast Fisheries Center's Galveston Laboratory for 10 months to increase survival, optimize growth and thereby reduce post-hatching mortality (Fontaine et al. 1985). However, recent (1985 and 1986) head start year classes exhibited accelerated growth and became extremely cramped in their rearing containers prior to release. Rapid growth and confinement of captive reared ridleys might render them less physically fit than their wild counter-parts because mobility is subsequently reduced as anatomical dimensions increase (Caillouet et al. 1986). The objective of the research reported herein was to conduct stamina tests to measure swimming performance of exercised and non-exercised head started Kemp's ridleys.

Thirty experimental turtles selected from one clutch were randomly assigned a plastic carton (30.5 cm wide X 32.7 cm long X 24.1 cm deep) or plastic bucket (24 cm deep X 26.2 cm inside diameter) rearing container, housed in a single raceway. Each type of container housed 15 experimental turtles. Experimental turtles were randomly assigned to one of three exercise categories. Categories included: (1) 10 turtles exercised twice weekly (Monday and Wednesday) and subjected to weekly stamina testing (Friday); (2) 10 turtles exposed only to weekly stamina testing (Friday); and (3) 10 non-exercised controls exposed to a single stamina test at the end of the study (17 April 1987). Swimming performance of Kemp's ridley hatchlings was measured in exercise and stamina tests conducted in a recirculating 46.4 cm wide X 210 cm long X 59.2 cm deep laminar flow tank. Current speeds produced in the tank ranged from 0 to 120 cm/sec. Turtles were acclimated in the test section of the flow tank 2 min prior to exposure to current flow.

Each turtle to be exercised (category 1) was placed in the flow tank test section twice weekly (Monday and Wednesday). Exercise was provided by setting water velocity at a rate which turtles would orient to and swim against. Exercise duration for each turtle was gradually increased from 5 to 30 min over 15 wk (Table 1). Exercise duration for the last 6 wk of the 21 wk study was 30 min. Initial exercise current speed of 12 cm/sec was gradually increased to 42 cm/sec over a 21 wk period (Table 1).

Stamina tests were conducted each Friday to examine differences in turtle fitness created by exercise regimen and/or rearing container. Stamina was defined as the time a turtle maintained its swimming position in current of known velocity. Stamina tests began by gradually increasing water velocity above exercise velocity. All stamina tests lasted for 10 min, unless the turtle was swept back against the downstream wire screen of the flow tank and exhibited no controlled

swimming motion. Tests were terminated after 5 min of inactivity. Weekly stamina tests were performed on all turtles (categories 1 and 2) except controls (category 3). All turtles, including controls, were exposed to a final stamina test on 17 April 1987. Current speeds during stamina tests began at 16 cm/sec and were increased 2-6 cm/sec biweekly (Table 1).

Table 1. Weekly duration and current speed regimen deployed in exercise sessions and stamina tests.

EXERCISE SESSION			STAMINA TEST		
Date	Duration (min)	Velocity (cm/sec)	Date	Duration (min)	Velocity (cm/sec)
11/24-26	05	12	11/28	10	16
12/01-03	05	16	12/05	10	20
12/08-10	05	20	12/12	10	26
12/15-17	05	22	12/19	10	26
12/22-24	10	24	12/26	10	30
12/29-31	10	26	01/02	10	30
01/05-07	10	28	01/09	10	32
01/12-14	10	30	01/16	10	32
01/19-21	15	30	01/23	10	34
01/26-28	15	30	01/30	10	34
02/02-04	20	30	02/06	10	36
02/09-11	20	30	02/13	10	36
02/16-18	25	30	02/20	10	38
02/23-25	25	30	02/27	*	*
03/02-04	30	30	03/06	10	40
03/09-11	30	34	03/13	10	44
03/16-18	30	34	03/20	10	44
03/23-25	30	38	03/27	10	48
03-30/04-01	30	38	04/03	10	48
04/06-08	30	42	04/10	10	52
04/13-15	30	42	04/17	10	52

* equipment malfunction

Swimming performances were quantified in terms of the amount of time spent swimming inefficiently and efficiently during each testing period beginning 5 January 1987. Inefficient swimming was defined as: (1) non-swimming periods longer than 2 sec, (2) periods of non-orientation into current, and (3) lack of front flipper movement. Swimming into the current with asynchronous and/or synchronous movements of the front flippers constituted efficient swimming (ES) periods. ES was analyzed by: (1) total time of efficient swimming (TES) in a test period, and (2) longest interval of efficient swimming (LES) during a test period.

Swimming data were analyzed by designating 25, 50, 75 and 96% of test duration (10 min) as performance levels. The upper limit was calculated from the mean swimming performance level of the best swimming hatchling from a randomly selected month. The number of category 1 and

2 turtles achieving each performance level by TES and LES standards was calculated for the 14 stamina test periods. Category 3 turtles (non-exercised controls) were excluded from statistical analyses because all turtles failed to achieve performance levels. Data, segregated by performance levels, were subjected to log linear model analyses to test the interaction and independence of test date, rearing container and exercise category (Sokal and Rohlf 1981). Non-significance ($P > 0.05$) of the interaction revealed each variable could be treated and analyzed independently by chi-square tests.

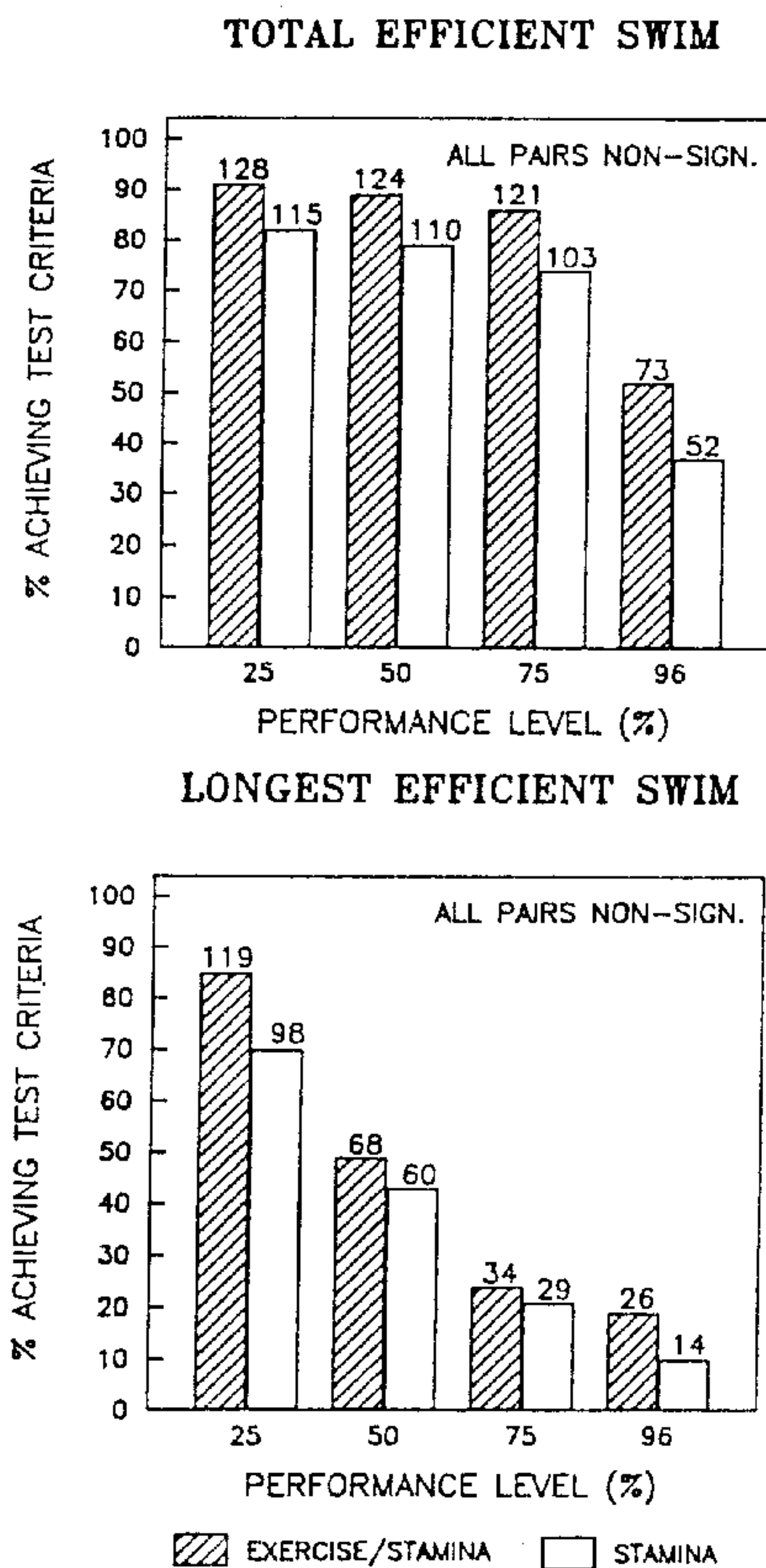


Figure 1. Percentage of category 1 (exercise/stamina) and category 2 (stamina) turtles achieving performance levels by total efficient swimming (top) and longest efficient swimming (bottom) criteria (non-significant $P > 0.05$; each bar is labeled with the number of turtles achieving test criteria out of a possible 140).

Test date did not have a significant ($P > 0.05$) effect on swimming performance at any level. Similarly, no statistical difference ($P > 0.05$) was found between category 1 and 2 turtles at any performance level by TES and LES standards. The number of exercised turtles (category 1) achieving each performance level was higher than that for hatchlings exposed only to weekly stamina tests (Figure 1).

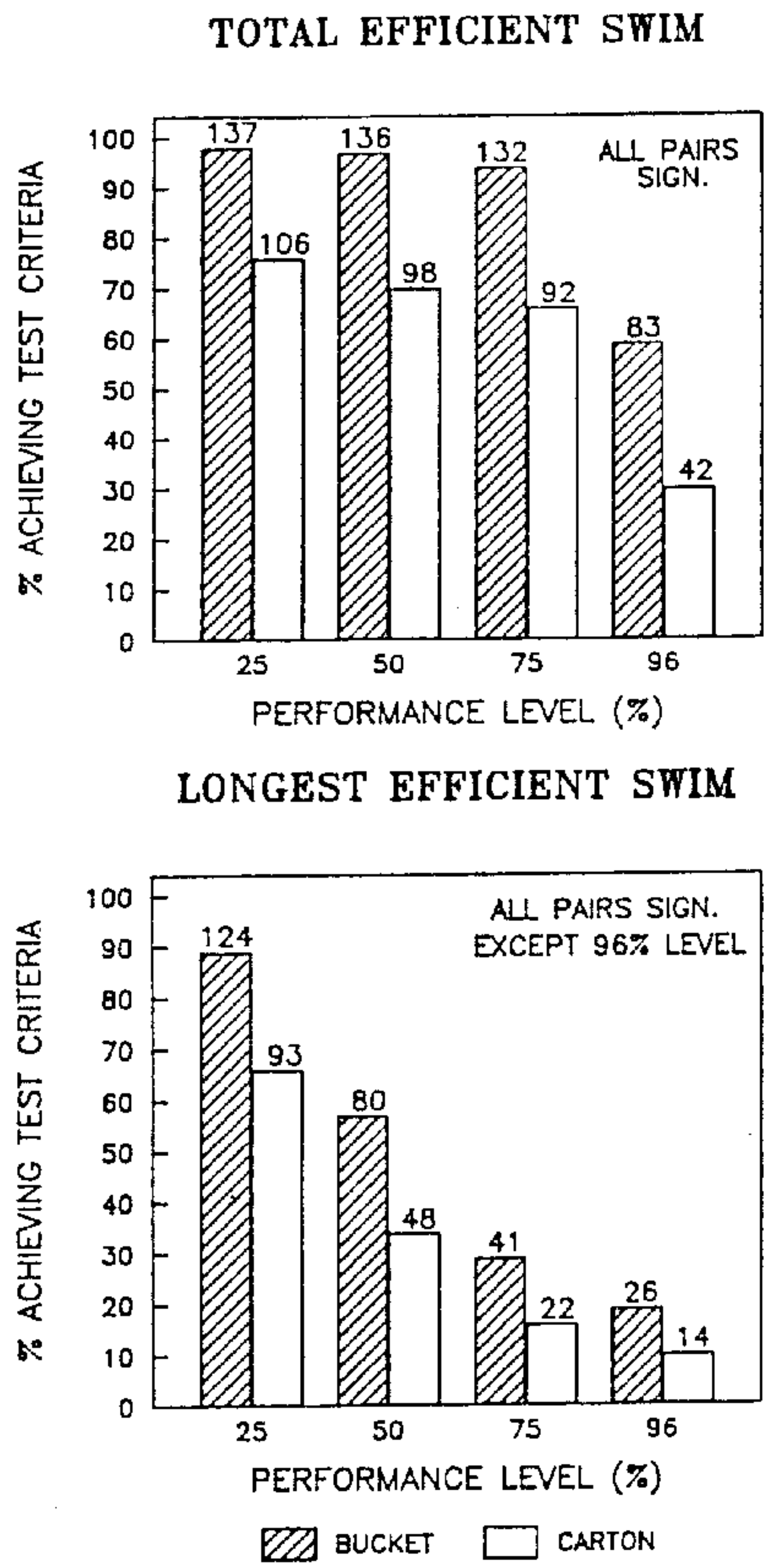


Figure 2. Percentage of bucket and carton reared turtles achieving performance levels by total efficient swimming (top) and longest efficient swimming (bottom) criteria (significant $P \leq 0.05$; each bar is labeled with the number of turtles achieving test criteria out of a possible 140).

A significant difference ($P > 0.05$) was found between bucket and carton reared hatchlings at all performance levels measured by TES and LES criteria, except the 96% LES level. Consistently, more bucket reared hatchlings achieved performance levels than did carton reared conspecifics (Figure 2).

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